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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

October 2, 1998

Ms. Magalie Roman Salas
Secretary - Federal Communications Commission
1919 M Street, N.W. Room 222
Washington, D.C. 20554

RE: CC Docket Nos. 96-45 ad 97-160

Dear Ms. Salas,

Yesterday, representatives of the Bencmark Cost Proxy Model (BCPM) Sponsors met with members of the Commission staff with regard to the above referenced proceedings. Representing the BCPM sponsors were Jim Stegeman of Indetec, Whit Jordan of BellSouth, Glen Brown of US West, and Brian Staihr and myself of Sprint. In attendance for the Commission staff were Craig Brown, Bryan Clopton, Chuck Keller, Katy King, Bob Loube, Jeff Prisbrey, and Don Stockdale.

The purpose of the meeting was to 1) provide a demonstration of the HCPM/BCPM interface, 2) review problems with the HCPM, 3) review HCPM run results and a comparison of these results to BCPM output, 4) present a case study for switching cost inputs into the BCPM switching module that does not rely in any way upon the BellCore SCIS model, and 5) discuss the lack of access and availability for parties to run the HCPM using PNR customer location data Attached are materials that were provided and discussed during this meeting.

The original and three copies of this notice are being submitted to the Secretary of the FCC in accordance with Section 1.1206(b)(1) of the Commission's rules. If there are any questions, please call

Sincerely,

Peter Sywenki

Pete Sywenki

Attachments

- BCPM/HCPM platform is 95% complete.
    - This platform offers improvements over the current HAI/HCPM platform
        - Mapping of BCPM inputs to HCPM input files. The BCPM provides the detail and the means to map the detail to the HCPM intermediate values.
        - Truing up of line counts to the Actual Wirecenter line counts (if actuals are available)
        - Compressed file storage and use of HCPM data. Currently, the HCPM data requires extensive use of disk space if left and processed in an uncompressed format.
        - Unified interface. The HCPM is actually an option and runs within the BCPM. For users of the HAI/HCPM, the user must run the HCPM first then the HAI.
        - BCPM runs on any machine with Excel97. HCPM only runs on machines with Access4 loaded. This is not standard on new machines nor on some older machines.

- Comparative Analysis are being made with actual geocoded data from 5 wirecenters in Florida. Using this data along with comparable cost of good inputs, the output from BCPM loop logic is being compared to output of HCPM logic. Initial results are attached

- The BCPM team is in the process of rewriting the Cluster code to make it more reviewable, maintainable, and auditable. This code should be available in the next week.

- HCPM code review is ongoing.
    - The HCPM is very difficult to review. There are no interim audit steps so that a reviewer can understand each step of the process. Unlike the HAI and BCPM, a user cannot follow the data through the model.
    - We have submitted three critiques of the code. However, we are still reviewing the code as we speak.

- As we understand, PNR data will be used in the model. The sponsors have requested access to the data to verify the working of the HCPM model. However at this time, we have not been permitted access to the data

- HAI has submitted new Expense and Switch modules.
    - Expense module now allows the user to input operating expenses on a per line basis
        - From initial reviews, it appears that the input for this level of expense is quite complex. For the Wirecenter level reporting, the user has to enter in over 100 data values for per line expense. For density zone reporting, it appears that the user is required to enter over 1000 data values.
    - Switching module now can use the LERG file to define Host and Remotes

    - While it appears to work, the impact is minimal since the default HAI inputs do not differentiate the cost of Host and remote switches.
    - It also appears that the HAI/HCPM assumes the user has the LERG7 files already on their machine in the proper format (based upon ex-parte at FCC)
- Transport module: we are reviewing how changes have impacted the Transport costs.

General Observations on HCPM model:

- Current HCPM does not seem to retain or use multiple residents or businesses per lot.
- We are unsure if PNR data uses housing unit data
- Terrain data is very gross (CBG level terrain of point nearest cluster Centroid)
- Current HCPM clustering code ends certain processes based on clock time
    - Therefore, users could obtain different results based on machine being used
- Current HCPM cannot support costs or subsidy calculation below the wirecenter
    - This is due to the fact that Feeder costs are aggregated at the wirecenter and then spread equally back to each line
        - For example, the customer next to the Central Office receives the same Feeder costs as the customer that is 10 miles out.
- Current HCPM uses T1 technology
- Current HCPM default scenario still uses 18k cluster
- Current HCPM does not true up to actual lines
- Current HCPM does not have detailed inputs
- Current HCPM does not seem to use the actual distribution of customers (Households and business lines) within the cluster. Rather, it seems the model assumes the Customers are equally spread over the populated raster cells of the cluster.
- Current HCPM code will be difficult to maintainable and audit
- Current HCPM does not take into account minimization of model resource requirements
    - Texas would not run a machine we supplied. The machine ran out of disk space.
- Current HCPM is based on less accurate On-Target wirecenters
- Current HCPM is based upon non-public data (Lerg7 and PNR data)
- Current HCPM density may be overstated due to use of only populated rasters
- Current HCPM may end up with loops over the user supplied max length. The model determines the clustering distance based on the distance from the cluster centroid to the raster cell centroid. Therefore, all points in the raster beyond the center of the raster cell for those at or near maximum length will exceed the maximum length.

Sample of Comments from review of Code

Critique of the Code

- It is considered poor practice to use the "+" symbol for concatenations. The "&" symbol should be used instead. When variants are used in string concatenations using

"+", the result is unpredictable. If all the variables can be treated as numeric, the variables are added together, instead of concatenated.

- The code is layout could be improved. As it stands, it will be difficult to maintain and audit. The standard method of coding would dictate that each method be given its own subroutine(s). This modular approach would simplify testing and validation.

- A variable naming convention should be used. This would make the code easier to read. There are several common naming conventions that can be adopted. This point is true for all of the HCPM modules.

- The output files are used to collect processing information. This statistical information should be kept in a separate file if it is necessary. Also the cluster results and the geo-coded points could be separated to simplify downstream processing.

- The file handling is inconsistent and prone to error.

Technique Relating to Speed:

- Each algorithm should be reviewed. Largely, the data is processed in large square matrices when triangular structures could be used. Changing the underlying approach would probably result in improved processing time.

- File structure could be improved. The structure of the geo-coded file contains too much information. It appears that the terrain data is common for each census block. If this information were removed from the input file and stored as either a separate file or in a database, then the amount of data for each geo-coded point would be reduced substantially. The reduction in input would open alternate methods that might speed up processing.

Algorithm Design:

- Different algorithms utilize different line limits. The Divisive algorithm use lines multiplied by the line fill factor, the other two methods use straight-line counts. It is not apparent to the user that this is happening

- The clustering methods are not consistent. In some the cases the constraints are hard-coded even though there are user inputs. The user inputs are not handled consistently. For instance, the line limits probably should be adjusted for the fill factor, but are not.

- There is no way to choose which clustering algorithm produces the 'best' results. For a given set of constraints, there should be some measure to indicate which clustering method would result in the minimum cable costs. Possibly the line weighted distance from the wire center switch location to each cluster plus the cluster line weighted distances would work.

- The graphs, while informative, should be removed from the processing. The graphs would probably work better if the clustering program had a review mode. The graphs for each method could then be reviewed at the same time.

- Various variables are hard coded. At times, these hard coded values are used instead of user inputs.

- The extent of Optimization is driven by the size of the wire-center. The larger the wirecenter (number of raster cells), the less optimization. The smaller wirecenter (number of raster cells) receives more optimization.

- Not sure why simple reassignment of clustering points is performed twice. Theoretically, as a point is reassigned, the cluster centroid should be recalculated and there should not be a need to do a second pass.

Network Design:

- The loop length of 18k (or a user supplied max cluster size) will be exceeded. The distance limit that is not adjusted for the length of the cell. When the final raster size is determined, the distance limit should be adjusted by 1/2 of the diagonal of the raster. Without adjustment there is a potential that the distances of individual points would exceed the distance limits when the feeder/distribution plant is built.

- When a set of clusters is optimized by noise reduction the process potentially terminates due to exceeding a time constraint. One obvious drawback of this method is that the number of iterations could vary by processor. When a process is terminated by a 'time out' condition, the results are left in the intermediate state.

Terrain:

- The terrain data for the output clusters are not correctly assigned. Terrain data is assigned to each cluster based on the terrain of the cell closest to the cluster centroid. There should be some method to develop weighted terrain data for each cluster.

Overview of comparative analysis:

Customer Data:
Sample customer geocoded datasets were developed for 5 wirecenters in Florida (mix of Urban and rural). These geocoded points were then put into the input format for both the BCPM and HCPM. This approach guarantees that the GIS inputs will not influence the comparison.

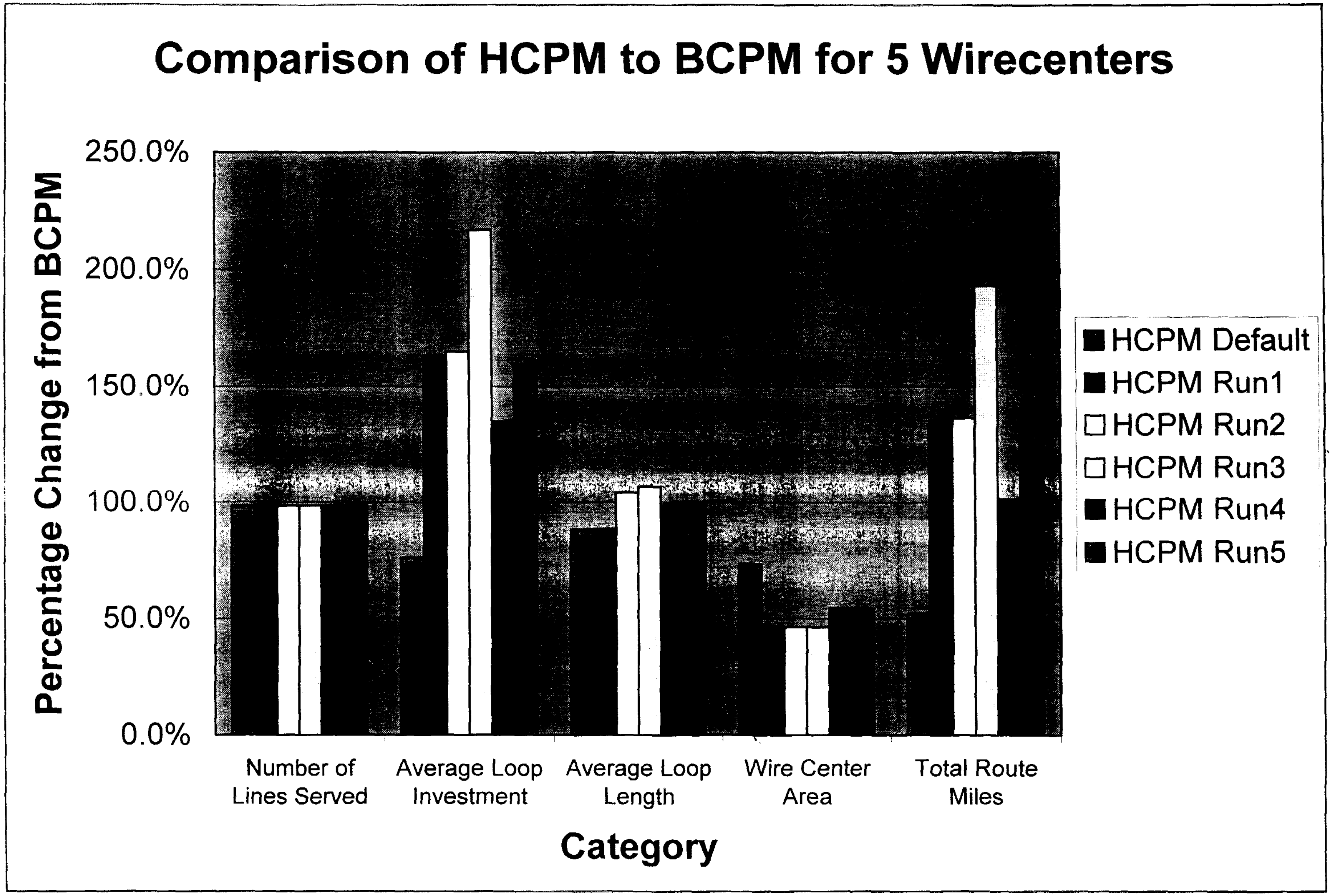
Comparative Runs:
The BCPM model was run with the BCPM Default cost inputs (cable costs, structure costs, etc..) (first data column of the Spreadsheet). The HCPM was run with HCPM default cost inputs and BCPM cost inputs. We also made these HCPM runs varying some other major parameters. The list below highlights the runs we made and the parameter settings.

- HCPM Default
  - 18kft cluster size
  - 2000 line criteria in sizing cluster
  - HCPM Default Cost inputs
  - Feeder Road to Route adjustment factor set to 1
  - Distribution Road to Route Adjustment set to 1
- HCPM Run1
  - 18kft cluster size
  - 2000 line criteria in sizing cluster
  - **BCPM** Default Cost inputs
  - Feeder Road to Route adjustment factor set to 1
  - Distribution Road to Route Adjustment set to 1
- HCPM Run2
  - 18kft cluster size
  - 2000 line criteria in sizing cluster
  - **BCPM** Default Cost inputs
  - Feeder Road to Route adjustment factor set to **1.2**
  - Distribution Road to Route Adjustment set to 1
- HCPM Run3
  - 18kft cluster size
  - 2000 line criteria in sizing cluster
  - **BCPM** Default Cost inputs
  - Feeder Road to Route adjustment factor set to **1.2**
  - Distribution Road to Route Adjustment set to **1.2**
- HCPM Run4
  - **12kft** cluster size
  - **1200** line criteria in sizing cluster
  - **BCPM** Default Cost inputs
  - Feeder Road to Route adjustment factor set to **1.2**
  - Distribution Road to Route Adjustment set to 1
- HCPM Run5
  - **12kft** cluster size
  - **1200** line criteria in sizing cluster
  - **BCPM** Default Cost inputs
  - Feeder Road to Route adjustment factor set to **1.2**
  - Distribution Road to Route Adjustment set to **1.2**

Comparison of BCPM and HCPM for 5 Wirecenters in Florida

	Wire Center	BCPM Default Run	HCPM Default: HCPM Default Run, 18kft Cluster, 2000 lines, Distribution and Fdr Road factor=1	HCPM Run1: HCPM with BCPM defaults, 18kf Cluster, 2000 lines, Dist. road Factor=1, Fdr=1	HCPM Run2: HCPM with BCPM defaults, 18kf Cluster, 2000 lines, Dist. road Factor=1, Fdr=1.2	HCPM Run3: HCPM with BCPM defaults, 18kf Cluster, 2000 lines, Dist. road Factor=1.2, Fdr=1.2	HCPM Run4: HCPM with BCPM defaults, 12kf Cluster, 1200 lines, Dist. road Factor=1, Fdr=1.2	HCPM Run5: HCPM with BCPM defaults, 12kf Cluster, 1200 lines, Dist. road Factor=1.2, Fdr=1.2	HCPM Default: HCPM Default Run, 18kft Cluster, 2000 lines, Distribution and Fdr Road factor=1	HCPM Run1: HCPM with BCPM defaults, 18kf Cluster, 2000 lines, Dist. road Factor=1, Fdr=1	HCPM Run2: HCPM with BCPM defaults, 18kf Cluster, 2000 lines, Dist. road Factor=1, Fdr=1.2	HCPM Run3: HCPM with BCPM defaults, 18kf Cluster, 2000 lines, Dist. road Factor=1.2, Fdr=1.2	HCPM Run4: HCPM with BCPM defaults, 12kf Cluster, 1200 lines, Dist. road Factor=1, Fdr=1.2	HCPM Run5: HCPM with BCPM defaults, 12kf Cluster, 1200 lines, Dist. road Factor=1.2, Fdr=1.2
	AVPKFLXADS0													
Number of Lines Served		14,819	14,564	14,564	14,564	14,564	14,560	14,560	98.3%	98.3%	98.3%	98.3%	98.2%	98.2%
Total Loop Investment		18,483,763	15,214,303	29,499,653	29,980,550	41,869,555	24,815,770	28,997,711	82.3%	159.6%	162.2%	226.5%	134.3%	156.9%
Average Loop Investment		1,247	1,045	2,026	2,059	2,875	1,704	1,992	83.8%	162.4%	165.0%	230.5%	136.6%	159.7%
Average Distribution Length		1,942.5	4,150.3	4,151.6	4,151.6	4,982.0	2,973.8	3,568.5	213.7%	213.7%	213.7%	256.5%	153.1%	183.7%
Average Feeder Length		22,290.8	15,018.9	16,599.2	20,500.5	20,500.5	19,704.2	19,353.8	67.4%	74.5%	92.0%	92.0%	88.4%	86.8%
Average Loop Length		24,233.3	19,169.2	20,750.9	24,652.1	25,482.4	22,678.0	22,922.3	79.1%	85.6%	101.7%	105.2%	93.6%	94.6%
Wire Center Area		92.9	62.3	40.0	40.0	40.0	50.2	50.2	67.1%	43.1%	43.1%	43.1%	54.1%	54.1%
Total Route Miles		365.3	257.8	509.6	514.4	781.2	375.8	463.7	70.6%	139.5%	140.8%	213.8%	102.9%	126.9%
	BVHLFLXADS0													
Number of Lines Served		12,551	12,329	12,329	12,329	12,329	12,329	12,329	98.2%	98.2%	98.2%	98.2%	98.2%	98.2%
Total Loop Investment		15,682,764	12,393,306	25,956,453	26,150,376	33,546,005	21,562,674	27,491,164	79.0%	165.5%	166.7%	213.9%	137.5%	175.3%
Average Loop Investment		1,249	1,005	2,105	2,121	2,721	1,749	2,230	80.4%	168.5%	169.8%	217.8%	140.0%	178.5%
Average Distribution Length		2,039.7	3,933.6	3,936.0	3,936.0	4,723.2	2,858.2	3,429.9	192.9%	193.0%	193.0%	231.6%	140.1%	168.2%
Average Feeder Length		20,029.7	14,890.7	15,861.4	18,018.0	17,934.7	17,727.6	17,346.7	74.3%	79.2%	90.0%	89.5%	88.5%	86.6%
Average Loop Length		22,069.3	18,824.2	19,797.4	21,954.0	22,658.0	20,585.8	20,776.6	85.3%	89.7%	99.5%	102.7%	93.3%	94.1%
Wire Center Area		67.1	38.5	24.0	24.0	24.0	29.0	29.0	57.3%	35.7%	35.7%	35.7%	43.2%	43.2%
Total Route Miles		329.7	211.3	443.6	447.0	618.8	324.0	461.8	64.1%	134.5%	135.6%	187.7%	98.2%	140.1%
	INVRFLXADS0													
Number of Lines Served		32,122	31,565	31,565	31,565	31,565	31,561	31,561	98.3%	98.3%	98.3%	98.3%	98.3%	98.3%
Total Loop Investment		41,487,346	29,317,811	64,734,347	65,285,359	85,376,120	53,939,661	62,167,356	70.7%	156.0%	157.4%	205.8%	130.0%	149.8%
Average Loop Investment		1,292	929	2,051	2,068	2,705	1,709	1,970	71.9%	158.8%	160.1%	209.4%	132.3%	152.5%
Average Distribution Length		1,645.6	4,114.5	4,116.3	4,116.3	4,939.6	3,193.6	3,832.4	250.0%	250.1%	250.1%	300.2%	194.1%	232.9%
Average Feeder Length		30,631.1	24,681.2	24,736.8	30,587.0	30,351.6	29,704.7	29,593.9	80.6%	80.8%	99.9%	99.1%	97.0%	96.6%
Average Loop Length		32,276.7	28,795.7	28,853.2	34,703.3	35,291.2	32,898.4	33,426.3	89.2%	89.4%	107.5%	109.3%	101.9%	103.6%
Wire Center Area		246.9	204.5	128.9	128.9	128.9	146.2	146.2	82.8%	52.2%	52.2%	52.2%	59.2%	59.2%
Total Route Miles		835.1	343.1	1,090.6	1,102.5	1,551.7	855.5	1,027.7	41.1%	130.6%	132.0%	185.8%	102.4%	123.1%
	LDLKFLXADS0													
Number of Lines Served		13,396	13,231	13,231	13,231	13,231	13,231	13,231	98.8%	98.8%	98.8%	98.8%	98.8%	98.8%
Total Loop Investment		14,338,718	10,591,862	24,191,098	24,282,578	29,875,725	18,844,770	21,241,267	73.9%	168.7%	169.3%	208.4%	131.4%	148.1%
Average Loop Investment		1,070	801	1,828	1,835	2,258	1,424	1,605	74.8%	170.8%	171.5%	211.0%	133.1%	150.0%
Average Distribution Length		1,182.7	3,137.1	3,138.4	3,138.4	3,766.0	2,429.0	2,914.8	265.3%	265.4%	265.4%	318.4%	205.4%	246.5%
Average Feeder Length		18,662.4	16,648.9	14,256.7	16,805.4	16,924.2	17,166.2	17,111.2	89.2%	76.4%	90.0%	90.7%	92.0%	91.7%
Average Loop Length		19,845.1	19,785.9	17,395.0	19,943.8	20,690.2	19,595.2	20,026.0	99.7%	87.7%	100.5%	104.3%	98.7%	100.9%
Wire Center Area		91.1	63.6	39.5	39.5	39.5	45.6	45.6	69.8%	43.4%	43.4%	43.4%	50.0%	50.0%
Total Route Miles		257.3	128.9	394.6	398.7	513.4	274.5	322.5	50.1%	153.4%	154.9%	199.5%	106.7%	125.3%
	LKHLFLXARS0													
Number of Lines Served		2,152	2,140	2,140	2,140	2,140	2,140	2,140	99.4%	99.4%	99.4%	99.4%	99.4%	99.4%
Total Loop Investment		2,924,180	2,265,789	5,011,394	5,084,569	7,556,555	4,167,814	5,671,209	77.5%	171.4%	173.9%	258.4%	142.5%	193.9%
Average Loop Investment		1,359	1,059	2,342	2,376	3,531	1,948	2,650	77.9%	172.4%	174.9%	259.9%	143.3%	195.0%
Average Distribution Length		1,610.3	3,516.2	3,517.8	3,517.8	4,221.3	3,135.1	3,762.2	218.4%	218.5%	218.5%	262.1%	194.7%	233.6%
Average Feeder Length		10,039.0	7,031.2	6,273.5	7,528.2	7,528.2	7,619.1	7,161.5	70.0%	62.5%	75.0%	75.0%	75.9%	71.3%
Average Loop Length		11,649.3	10,547.4	9,791.2	11,045.9	11,749.5	10,754.2	10,923.7	90.5%	84.1%	94.8%	100.9%	92.3%	93.8%
Wire Center Area		26.1	17.8	11.3	11.3	11.3	13.6	13.6	68.0%	43.1%	43.1%	43.1%	52.0%	52.0%
Total Route Miles		68.5	26.4	65.0	66.2	117.6	52.4	80.8	38.6%	95.0%	96.7%	171.8%	76.6%	118.0%
	Total/Avg Of 5													
Number of Lines Served		*75,041*	*73,829*	*73,829*	*73,829*	*73,829*	*73,821*	*73,821*	*98.4%*	*98.4%*	*98.4%*	*98.4%*	*98.4%*	*98.4%*
Total Loop Investment		*92,916,771*	*69,783,071*	*149,392,946*	*150,783,433*	*198,223,960*	*123,330,688*	*145,568,707*	*75.1%*	*160.8%*	*162.3%*	*213.3%*	*132.7%*	*156.7%*
Average Loop Investment		*1,238*	*945*	*2,023*	*2,042*	*2,685*	*1,671*	*1,972*	*76.3%*	*163.4%*	*164.9%*	*216.8%*	*134.9%*	*159.3%*
Average Distribution Length		*1,686.5*	*3,898.8*	*3,900.6*	*3,900.6*	*4,680.7*	*2,955.5*	*3,546.6*	*231.2%*	*231.3%*	*231.3%*	*277.5%*	*175.2%*	*210.3%*
Average Feeder Length		*24,483.6*	*19,189.1*	*19,236.1*	*23,360.1*	*23,286.9*	*22,844.4*	*22,641.2*	*78.4%*	*78.6%*	*95.4%*	*95.0%*	*93.3%*	*92.5%*
Average Loop Length		*26,170.1*	*23,087.9*	*23,136.6*	*27,260.7*	*27,947.6*	*25,799.9*	*26,187.8*	*88.2%*	*88.4%*	*104.2%*	*106.8%*	*98.6%*	*100.1%*
Wire Center Area		*524.2*	*386.7*	*243.6*	*243.6*	*243.6*	*284.7*	*284.7*	*73.8%*	*46.5%*	*46.5%*	*46.5%*	*54.3%*	*54.3%*
Total Route Miles		*1,855.9*	*967.5*	*2,503.6*	*2,528.8*	*3,582.7*	*1,882.2*	*2,356.5*	*52.1%*	*134.9%*	*136.3%*	*193.0%*	*101.4%*	*127.0%*

Developed by the BCPM Sponsors


Comparison of HCPM to BCPM for 5 Wirecenters
Percentage Change from BCPM
250.0%
200.0%
150.0%
100.0%
50.0%
0.0%
Number of Lines Served
Average Loop Investment
Average Loop Length
Wire Center Area
Total Route Miles
Category
HCPM Default
HCPM Run1
HCPM Run2
HCPM Run3
HCPM Run4
HCPM Run5

BCPM Default Inputs for HCPM tables

Annual Charge Factors	
[redacted]	
20.34%	ac_ugd_cop
18.57%	ac_bur_cop
20.38%	ac_aer_cop
17.18%	ac_ugd_fib
16.96%	ac_bur_fib
17.44%	ac_aer_fib
14.57%	ac_ugd_struc
18.57%	ac_bur_struc
18.29%	ac_aer_struc
14.57%	ac_manhole
20.38%	ac_t1_term
20.38%	ac_fib_term
19.77%	ac_fdi
17.19%	ac_fib_splice

BCPM Default Inputs for HCPM tables

26 Gauge Copper Costs (per ft)			
4200	$ 35.60	$ 33.16	$ 37.18
3600	$ 33.30	$ 30.20	$ 34.01
3000	$ 28.21	$ 29.19	$ 33.36
2400	$ 21.50	$ 26.79	$ 26.26
2100	$ 19.49	$ 22.60	$ 20.88
1800	$ 17.38	$ 20.46	$ 19.28
1200	$ 11.95	$ 13.20	$ 12.78
900	$ 9.98	$ 10.70	$ 9.86
600	$ 7.52	$ 7.27	$ 7.21
400	$ 6.55	$ 5.67	$ 5.58
300	$ 4.42	$ 4.38	$ 4.88
200	$ 3.60	$ 3.49	$ 3.84
100	$ 2.65	$ 2.52	$ 2.99
50	$ 1.19	$ 2.16	$ 2.59
25	$ 1.00	$ 1.93	$ 2.50
18	$ 1.00	$ 1.93	$ 2.50
12	$ 1.00	$ 1.93	$ 2.50
6	$ 1.00	$ 1.00	$ 2.50
1	$ 1.00	$ 1.00	$ 2.50

Fiber Feeder Costs (per ft)			
288	$ 11.50	$ 12.79	$ 12.02
144	$ 10.30	$ 9.96	$ 9.85
96	$ 7.40	$ 7.43	$ 7.19
72	$ 6.25	$ 6.00	$ 6.75
60	$ 5.50	$ 5.17	$ 6.02
48	$ 4.75	$ 4.95	$ 5.27
36	$ 4.15	$ 4.01	$ 4.67
24	$ 3.75	$ 3.93	$ 3.45
18	$ 3.48	$ 3.25	$ 3.26
12	$ 3.09	$ 2.75	$ 3.04
1	$ 3.09	$ 2.75	$ 3.04

BCPM Default Inputs for HCPM tables

Drop Terminal Costs			
[redacted]			
1	$ 157.05	$ 95.98	$ 157.05
6	$ 157.05	$ 95.98	$ 157.05
12	$ 440.87	$ 131.81	$ 440.87
25	$ 451.00	$ 216.00	$ 451.00

BCPM Default Inputs for HCPM tables

Feeder Plant Mix

0	10.00%	50.00%	40.00%
5	15.00%	45.00%	40.00%
100	20.00%	40.00%	40.00%
200	25.00%	35.00%	40.00%
650	45.00%	30.00%	25.00%
850	65.00%	25.00%	10.00%
2550	80.00%	20.00%	0.00%
5000	90.00%	10.00%	0.00%
10000	95.00%	5.00%	0.00%

Distribution Plant Mix

0	0.0%	60.0%	40.0%
5	2.0%	61.0%	37.0%
100	5.0%	62.0%	33.0%
200	8.0%	62.0%	30.0%
650	15.0%	65.0%	20.0%
850	25.0%	65.0%	10.0%
2550	40.0%	55.0%	5.0%
5000	60.0%	35.0%	5.0%
10000	90.0%	10.0%	0.0%

BCPM Default Inputs for HCPM tables

Manhole Spacing	
[redacted]	
0	725
5	725
100	725
200	725
650	550
850	550
2550	550
5000	550
10000	550

Installed Manhole Costs						
[redacted]						
2	$	1,008.00	$	1,158.00	$	1,308.00
4	$	3,404.93	$	3,764.93	$	4,124.93
9	$	4,512.00	$	4,832.00	$	5,152.00
99	$	2,640.00	$	2,800.00	$	2,960.00

BCPM Default Inputs for HCPM tables

Structure Costs Assigned to Telephone			
[illegible]	[illegible]	[illegible]	[illegible]
0	100.00%	100.00%	50.00%
5	97.50%	95.00%	50.00%
100	95.00%	90.00%	50.00%
200	92.50%	80.00%	50.00%
650	90.00%	80.00%	50.00%
850	90.00%	80.00%	50.00%
2550	85.00%	80.00%	50.00%
5000	85.00%	80.00%	50.00%
10000	85.00%	80.00%	50.00%

Fill Factors		
[illegible]	[illegible]	[illegible]
0	75.00%	100.00%
5	80.00%	100.00%
100	80.00%	100.00%
200	85.00%	100.00%
650	85.00%	100.00%
850	85.00%	100.00%
2550	85.00%	100.00%
5000	85.00%	100.00%
10000	85.00%	100.00%

BCPM Default Inputs for HCPM tables

Softrock Structure Placement Cost (per ft)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0	$ 4.01	$ 4.25	$ 2.10	$ 2.23	$ 3.54	$ 3.54
5	$ 4.28	$ 4.50	$ 2.48	$ 2.27	$ 3.54	$ 3.54
100	$ 4.93	$ 5.13	$ 3.46	$ 3.20	$ 3.54	$ 3.54
200	$ 5.67	$ 5.66	$ 5.50	$ 5.59	$ 3.54	$ 3.54
650	$ 6.56	$ 6.76	$ 6.57	$ 6.86	$ 5.86	$ 5.86
850	$ 6.56	$ 6.76	$ 6.57	$ 6.86	$ 6.22	$ 6.22
2550	$ 9.51	$ 9.53	$ 9.51	$ 9.53	$ 6.22	$ 6.22
5000	$ 9.51	$ 9.53	$ 9.51	$ 9.53	$ 6.22	$ 6.22
10000	$ 10.43	$ 10.43	$ 10.43	$ 10.43	$ 6.22	$ 6.22

Normal Structure Placement Cost (per ft)

[illegible]	[illegible]	Distr[illegible]	Feeder	Distr[illegible]	Feeder	[illegible]
0	$ 2.76	$ 2.70	$ 1.35	$ 1.47	$ 3.12	$ 3.12
5	$ 3.04	$ 3.04	$ 1.79	$ 1.73	$ 3.12	$ 3.12
100	$ 3.93	$ 3.66	$ 2.96	$ 2.48	$ 3.12	$ 3.12
200	$ 4.53	$ 4.47	$ 4.18	$ 4.36	$ 3.12	$ 3.12
650	$ 5.27	$ 5.28	$ 5.18	$ 5.22	$ 5.17	$ 5.17
850	$ 5.27	$ 5.28	$ 5.18	$ 5.22	$ 5.49	$ 5.49
2550	$ 8.22	$ 8.23	$ 8.22	$ 8.23	$ 5.49	$ 5.49
5000	$ 8.22	$ 8.23	$ 8.22	$ 8.23	$ 5.49	$ 5.49
10000	$ 8.84	$ 8.84	$ 8.84	$ 8.84	$ 5.49	$ 5.49

Hardrock Structure Placement Cost (per ft)

[illegible]	[illegible]	Distr[illegible]	Feeder	Distr[illegible]	Feeder	Distr[illegible]
0	$ 5.27	$ 5.20	$ 3.41	$ 3.70	$ 3.96	$ 3.96
5	$ 5.89	$ 5.74	$ 3.95	$ 3.95	$ 3.96	$ 3.96
100	$ 6.73	$ 6.57	$ 4.91	$ 4.96	$ 3.96	$ 3.96
200	$ 7.73	$ 7.73	$ 7.48	$ 7.25	$ 3.96	$ 3.96
650	$ 8.78	$ 8.71	$ 8.85	$ 8.92	$ 6.56	$ 6.56
850	$ 8.78	$ 8.71	$ 8.85	$ 8.92	$ 6.93	$ 6.93
2550	$ 12.18	$ 12.18	$ 12.18	$ 12.18	$ 6.93	$ 6.93
5000	$ 12.18	$ 12.18	$ 12.18	$ 12.18	$ 6.93	$ 6.93
10000	$ 13.01	$ 13.01	$ 13.01	$ 13.01	$ 6.93	$ 6.93

BCPM Default Inputs for HCPM tables

State Line Count Table

AK	0.933000	1.173494	0.116667	0.200000	0.633333	0.050000
AL	0.920000	1.182063	0.162107	0.131464	0.673102	0.033326
AR	0.873000	1.151304	0.080987	0.127865	0.740973	0.050175
AZ	0.938000	1.198557	0.093686	0.058171	0.821961	0.026181
CA	0.951000	1.231748	0.029251	0.110228	0.836390	0.024131
CO	0.948000	1.210303	0.056498	0.070668	0.851388	0.021446
CT	0.984000	1.121532	0.053861	0.056164	0.854387	0.035588
DC	0.931000	1.359904	0.187597	0.007140	0.792536	0.012728
DE	0.973000	1.240886	0.033471	0.070933	0.868742	0.026854
FL	0.933000	1.297484	0.074396	0.162422	0.734388	0.028794
GA	0.868000	1.276291	0.200255	0.101665	0.669147	0.028934
HI	0.960000	1.239313	0.022723	0.552828	0.394212	0.030238
IA	0.980000	1.072152	0.149496	0.164477	0.661465	0.024561
ID	0.921000	1.177310	0.061220	0.174447	0.738723	0.025610
IL	0.930000	1.187979	0.016400	0.138419	0.820889	0.024292
IN	0.945000	1.126663	0.015744	0.161714	0.792346	0.030195
KS	0.943000	1.136073	0.114175	0.085262	0.762016	0.038548
KY	0.928000	1.109984	0.104208	0.217424	0.641413	0.036954
LA	0.916000	1.213352	0.063520	0.085765	0.811363	0.039352
MA	0.952000	1.297066	0.030142	0.140177	0.795592	0.034089
MD	0.965000	1.192097	0.091040	0.049204	0.833057	0.026699
ME	0.968000	1.244377	0.017105	0.169839	0.774389	0.038667
MI	0.955000	1.198847	0.006549	0.155994	0.805925	0.031532
MN	0.972000	1.137531	0.053553	0.054244	0.873132	0.019071
MO	0.948000	1.146668	0.106726	0.131471	0.719791	0.042011
MS	0.879000	1.134127	0.173054	0.137119	0.647886	0.041940
MT	0.946000	1.115461	0.031036	0.129729	0.803759	0.035476
NC	0.953000	1.180033	0.170828	0.165781	0.636627	0.026764
ND	0.969000	1.201585	0.107545	0.182419	0.679341	0.030694
NE	0.958000	1.124622	0.051232	0.088821	0.829396	0.030551
NH	0.945000	1.326186	0.016905	0.184101	0.764815	0.034179
NJ	0.928000	1.423527	0.080206	0.052637	0.830939	0.036218
NM	0.861000	1.201954	0.064556	0.134936	0.768173	0.032335
NV	0.927000	1.268435	0.007105	0.067347	0.908884	0.016663
NY	0.932000	1.291712	0.072653	0.096604	0.788478	0.042265
OH	0.945000	1.133245	0.016056	0.171986	0.782189	0.029769
OK	0.924000	1.122816	0.083095	0.122041	0.747668	0.047197
OR	0.963000	1.120184	0.128453	0.173894	0.672776	0.024877
PA	0.969000	1.172942	0.030478	0.111313	0.829879	0.028330
PR	1.000000	1.120600	0.010283	0.473282	0.431686	0.084749
RI	0.953000	1.229192	0.007623	0.249509	0.712631	0.030237
SC	0.913000	1.189515	0.197968	0.150646	0.615349	0.036036
SD	0.942000	1.109015	0.158043	0.109577	0.698491	0.033889
TN	0.941000	1.212437	0.130223	0.092161	0.744901	0.032714
TX	0.914000	1.190201	0.074176	0.115058	0.781432	0.029334
UT	0.970000	1.190208	0.060752	0.065624	0.851148	0.022476
VA	0.938000	1.163345	0.096552	0.093218	0.784140	0.026091
VT	0.960000	1.261500	0.016972	0.211243	0.734578	0.037208
WA	0.948000	1.156880	0.062218	0.166437	0.745216	0.026129
WI	0.969000	1.162538	0.010093	0.127034	0.836416	0.026457
WV	0.931000	1.067527	0.052821	0.105333	0.794598	0.047248
WY	0.953000	1.107594	0.050788	0.111579	0.799731	0.037902

BCPM Default Inputs for HCPM tables

Feeder Distribution Interface Costs		
[illegible]	[illegible]	[illegible]
1	$ 407.00	$ 340.00
50	$ 407.00	$ 509.43
100	$ 1,885.00	$ 811.60
200	$ 2,120.00	$ 1,293.09
400	$ 2,355.00	$ 2,324.03
600	$ 5,509.00	$ 3,757.00
900	$ 6,848.00	$ 4,901.36
1200	$ 7,586.00	$ 6,867.06
1800	$ 8,717.00	$ 8,658.36
2400	$ 11,490.00	$ 13,559.71
3600	$ 14,055.60	$ 19,605.42
5400	$ 21,083.40	$ 30,876.42
7200	$ 28,111.20	$ 39,210.84

BCPM Default Inputs for HCPM tables

Miscellaneous Engineering Inputs	
[illegible]	[illegible]
0.5	max_drop_length
0.5	user_lambda
1	takerate
2	lines_per_house
11.1	copper_gauge_xover
1.26	multiplier_24
13.6	max_copper_distance
2	MaxCopperPenalty
12	copper_t1_xover
12	t1_fiber_xover
2400	copper_line_max
2400	t1_line_max
1.25	t1_redundancy_factor
4200	feed_copper_cable_capacity
3600	dist_copper_cable_capacity
288	fiber_cable_capacity
24	copper_placement_depth
36	fiber_placement_depth
3	CriticalWaterDepth
1.3	WaterFactor
12	MinSlopeTrigger
1.1	MinSlopeFactor
30	MaxSlopeTrigger
1.05	MaxSlopeFactor
1.2	CombSlopeFactor
1.2	SoilTexFactor
1345	th2016
193	th672
25	th96
0.35	pct_ds1
0.5	pct_lsa
0.13	SpclAccessRatio
6	lines_per_bus
10	SpclAccessLines_per_bus
1.2	DistRoadFactor
1	FiberFillFactor
2	DistanceType
1.2	FeederRoadFactor
1	Max_SAIs

Miscellaneous Cost Inputs	
Value	Description
$ 770.00	cost_per_drop_kf
$ 30.73	nid_cost
$ 830.00	duct_cost_per_kf
$ 192,117.00	a2016
$ 129.04	b2016
$ 90,553.00	a672
$ 129.04	b672
$ 36,501.32	a96
$ 120.29	b96
$ 30,388.33	a24
$ 120.29	b24
$ 36,501.32	ac96
$ 120.29	bc96
$ 30,388.33	ac24
$ 120.29	bc24
$ -	fiber_splice_cost
Note: Input for 18kft Cluster Runs	

Miscellaneous Cost Inputs	
Value	Description
$ 770.00	cost_per_drop_kf
$ 30.73	nid_cost
$ 830.00	duct_cost_per_kf
$ 192,117.00	a2016
$ 82.41	b2016
$ 90,553.00	a672
$ 82.41	b672
$ 36,501.32	a96
$ 89.04	b96
$ 30,388.33	a24
$ 89.04	b24
$ 36,501.32	ac96
$ 89.04	bc96
$ 30,388.33	ac24
$ 89.04	bc24
$ -	fiber_splice_cost
Note: Input for 12kft Cluster Runs	

AN ALTERNATIVE SWITCH PARTITIONING PROCESS

A Case Study and Proposal for Cost Proxy Model Inputs

Prepared by the BCPM Sponsors

September 15, 1998

SWITCH INVESTMENT PARTITIONING FOR COST PROXY MODELS

Why is switch partitioning needed?

Regardless of the proxy model selected by the state or federal regulators, switch partitioning provides an unbiased process for the development of switch investment inputs for the proxy model. The switch partitioning process is grounded in the underlying engineering of switching equipment, is not arbitrary and is consistent with the cost-causation principles of incremental cost theory. By not doing so, the Commission would be using arbitrary allocations of switch investment to determine network element investments. That would clearly violate the Commission's own TELRIC principles, which are based in incremental cost theory.

Why do we need the cost of network elements?

The FCC has encouraged states to use (and, in fact, many states are using) the same methodology for universal service cost support and pricing of unbundled network elements (UNE). Given a set of discrete network functions, it is possible to create a mapping between basic switch functions and the pieces of switch hardware that support each. This would be analogous to taking an automobile and identifying the separate systems that make it up, such as steering, braking, occupant seating, etc It is certainly possible to identify the cost of each automotive subsystem; likewise the cost of each functional area of the switch can be identified. It is then possible to in turn create a consistent mapping between the switch functional investments and UNEs or with basic service for Universal Service Obligations.

Why is it important to identify the individual switch element costs? Why not use a simple cost function that computes the total cost of the switch and gives us the switching cost on a per line basis? The answer is that the switching costs are typically not simply driven by the number of lines nor is the switching function tariffed on a per-line basis. The FCC has specified that the discrete functional elements of the switch will be unbundled and sold separately. These discrete network elements are the fundamental premise of the Total Element Long Run Incremental Cost (TELRIC) pricing methodology created by the FCC. Line ports, local usage, and interoffice transport, for example, are all separate network functions as defined by the Commissions.

Remember that the unbundled network element structure was set up by the Commissions, not the LECS, and is a condition for opening the telephony market to competition. It would be irresponsible for the Commissions to set up a business structure that provides for unbundled network elements, and requires prices for those elements based on incremental cost, without also using a cost model that is capable of producing these same incremental costs. In addition, the same detail used to support UNEs should be used to construct a more accurate cost of switching associated with Universal Service.

How do the BCPM functional investment categories support these network elements?

The BCPM's fundamental structure was designed around the network elements that comprise UNEs and universal service. BCPM has a set of discrete switch functional investment categories that is simple, yet detailed enough to cost the network elements without arbitrary allocations.

Why do other switch cost inputs under consideration, such as the HAI model and the Gabel/Kennedy switch cost model, not meet the requirement for long run incremental costs?

The HAI and Gabel/Kennedy switch investment curves cannot, by themselves, provide long run incremental costs because they both provide investment estimates for the entire switch, not the network elements. In addition, they provide investments that represent broad averages at the national level. This lack of geographic specificity will provide a distorted picture of the costs at many specific wire centers and does not provide company-specific studies, which the FCC supports. This distorted cost picture can be detrimental to the competitive landscape.

What models can be used to create the functional switch investments?

Traditionally, engineering-based models such as the Bellcore Switching Cost Information System (SCIS) have been used in regulatory proceedings to identify forward-looking costs for switched services. Following is a case study describing a simplified approach to creating a partitioned switch investment model. Such an approach would enable the BCPM to produce incremental switch costs without proprietary models.

CASE STUDY

CREATION OF A PARTITIONED SWITCH INVESTMENT MODEL

Introduction - The Issue

In order to set prices for unbundled network elements (UNE) and determine support levels for universal service in the United States, it is absolutely necessary to create cost models that identify the long run incremental cost of each network element. Long run incremental costs by definition do not include any costs derived solely by means of arbitrary allocations or accounting classifications. The portion of the telephone network that presents perhaps the biggest challenge in conceptualizing network element investments is the central office switch. The switch provides several discrete network elements, such as line ports and local usage. Each element represents a complex assemblage of both unique and shared electronic components within the switch. The local loop developed in the proxy models, by contrast, while the subject of lengthy debate concerning the location of customers and network design, ultimately comprises only one network element - the local 2-wire loop.

The currently advocated alternatives for determining the cost of these switching network elements present intractable problems for utilities regulators and interested parties who must review UNE and universal service cost studies presented by telecom companies and intervenors. On one hand, some parties present cost models for switching that comprise a simple linear or perhaps logarithmic function. This function produces either a total cost per switch or cost per line that represents all of the switch's equipment. These models have appeal because of their simplicity and because they are often based on data, such as regulatory depreciation studies, that are available to the public (but often must be purchased). The simple single-function models have a fatal flaw, however: they cannot produce element-specific investments without arbitrary allocations of the total switch investment.

On the other hand, many incumbent local exchange carriers (ILECS) use cost models that are based on the same detailed formulas used to engineer the switches[1]. The most commonly used switch investment cost model in the U.S. is the Bellcore Switching Cost Information System (SCIS). SCIS, while generally acknowledged to be a precise means for computing incremental switch investments, has met varying levels of acceptance among regulators and interested parties. Organizations that oppose SCIS, or accept it only grudgingly, object to the model's complexity and confidentiality, and mistrust the motives of its proponents. Opponents to SCIS frequently claim that the model produces unreliable results because its users have too many ways to unfairly manipulate the model's inputs. These issues are exacerbated by the fact that Bellcore is vigilant in keeping the model's internal algorithms and programming code confidential, and unavailable for public review

Case Background

INDETEC International, Inc., is a leading consulting firm in utilities cost analysis and pricing matters. In 1997 INDETEC, in partnership with a market entrant in a newly competitive local exchange market, agreed to examine the long run incremental cost of interconnection for local switching. The regulatory body having jurisdiction in this market promotes fair and objective competition in the telecom market, with the long-term objective of benefiting all telecommunications users. The regulators established several guiding principles for determining interconnection charges:

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[1] In practice, each switch is effectively custom engineered to meet the requirements of the location in which it is installed. The switch vendor provides a software model that takes the unique parameters of the location, such as usage levels, line counts and service set, and provides a dollar quote for the required switching machine.

1. Efficiency - Interconnection charges must appropriately reflect interconnections costs incurred by an efficiently managed carrier;
2. Objectivity - Interconnection charges, and the basis for calculating them, must be subject to external evaluation;
3. Nondiscrimination - Interconnection must be provided under the same conditions for all carriers; and
4. Diversity - Carriers must be able to freely select and combine the specific network functions with which they wish to interconnect. This means that network functions must be unbundled and charges must be broken down according to the constituent facility elements and functions.

INDETEC noted that these principles were consistent with the Total Element Long Run Incremental Cost (TELRIC) guidelines specified by the FCC in several orders implementing the interconnection and universal service provisions of the Telecommunications Act of 1996[2]. A single total switch cost function was clearly not acceptable in this case, because TELRIC principles require that the incremental costs of network elements, such as line ports and usage, be computed separately without arbitrary allocations. An engineering based model such as SCIS was not available. INDETEC therefore proposed to construct a simplified engineering based model that would be open, verifiable and at the same time provide genuine element-specific TELRIC costs for switched local interconnection. The client agreed and the effort to partition the switch into functionally significant categories, consistent with the interconnection rate structure, began.

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[2] See Implementation of the Local Competition Provisions in the Telecommunications Act of 1996, CC Docket No. 96-98, FCC 96-325 (released August 8, 1996) and In the Matter of Federal-State Joint Board on Universal Service, CC Docket no. 96-45, (released May 8, 1997).